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LOG HOME CONSTRUCTION AND MAINTENANCE TIPS:

HOW TO PREVENT DECAY AND INSECTS

GEORGIA FORESTRY COMMISSION

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LOG HOME CONSTRUCTION AND MAINTENANCE TIPS:

HOW TO PREVENT DECAY AND INSECTS

BY

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INTRODUCTION

Log houses have again become very popular throughout the South. Personal experience and numerous inquiries from owners of log homes indicate that many of these homes are highly susceptible to damage by decay fungi and insects. In most instances, the problems occur because of combinations of three factors--the type of logs used in construction, designs that do not protect logs from rainwetting, and lack of maintenance of exterior wall surfaces.

Most of the historic log structures in the South were constructed of the durable heartwood of relatively large, slow-grown trees, whereas most modern log homes are constructed of logs from small diameter, fast-grown trees consisting of sapwood that is susceptible to decay fungi and insects. Also, many of the older log structures were single-story and featured wide roof overhangs and long porches that protected logs from weather. Many modern log homes are two-story, have very short roof overhangs, and have few porches. While these design features are acceptable in northern climates, they do not sufficiently protect the exterior log surfaces of homes in warm, humid southern climates more favorable to decay. Experience has shown that the use of unfinished, untreated sapwood siding or logs on the exterior of buildings in the South whose walls are not protected by porches or roof overhangs almost invariably leads to attack by insects and decay fungi.

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PREVENTING DECAY AND INSECTS BY PROPER LOG HANDLING

Decay and Insect Prevention Begins With the Manufacturer

Many problems with decay and insects could be eliminated by utilizing logs rapidly and by protecting them during seasoning and storage. Rapid utilization requires removing the logs from the woods and debarking them as soon as possible after cutting. For both fungi and insects, colonization of logs is less likely if trees and logs are cut in late fall and winter.

Logs that are left unprotected for several weeks after being cut often become colonized by a variety of fungi. These logs usually can be recognized by examining the ends for discolorations, often wedge-shaped, caused by stain fungi (Fig. 1). The ends of logs that are used rapidly and are protected from fungi during seasoning will be free of irregular-shaped discolorations.

Fig. 1. *Blue staining fungi. (USFS Photo)*

After logs are removed from the woods and debarked, they should be dipped in a preservative chemical and stored off the ground, preferably under a roof, to air dry. This chemical treatment is only designed to protect the logs while they dry, not to provide permanent protection. It is very hazardous to construct log homes from small-diameter, unseasoned logs or logs that have not been debarked.

Some log home manufacturers prefer to kiln-dry, or at least partially kiln-dry, their logs after debarking them. This is a good practice, provided that the kiln-dried logs are protected from being rewetted during storage. Temperatures reached during kiln-drying should be high enough to kill beetle larvae and fungi in the logs.

Other manufacturers have their log-kits fumigated with toxic gases. Fumigation provides no long-lasting protection and does not necessarily ensure against beetle infestations. Beetles and fungi may infest unseasoned, fumigated wood within days after treatment.

Practices for handling and storing logs should be adapted to the specific preservative treatment procedures being used.[1] Procedures now being used include: superficial dip treatment of **unseasoned** logs in fungicides to control molds and stain fungi, dip treatment of **unseasoned** logs in diffusible chemicals to control insects and decay fungi, and pressure treatment of **seasoned** logs to control insects and decay fungi. Logs treated by all of these procedures will require the application of maintenance treatments to the exterior walls of homes constructed from them. However, the combination of chemicals and frequency of treatment will vary depending on procedures used during manufacture.

Non-diffusible chemicals used for dip treatment primarily coat the surface of unseasoned logs and only slightly penetrate seasoned ones. Diffusible chemicals (e.g., borates), can penetrate deeply into **unseasoned** logs when used for dip treating and can penetrate deeply into unseasoned or seasoned logs when used in pressure treatments. The water-borne preservatives used to pressure treat logs (e.g., chromated copper arsenate and zinc naphthenate) can penetrate deeply into **seasoned** logs; unfortunately, some manufacturers attempt to treat unseasoned logs with these preservatives.

Diffusible chemicals (borates) move through the water in unseasoned wood from areas of high concentration on the surface to one of lower concentration within wood. Penetration is best when wood moisture content is high. An advan-

[1]/ Log home construction and maintenance: Preventing decay and insect problems by Terry L. Amburgey and Lonnie H. Williams, Mississippi State University Bulletin in preparation.

tage to the buyer of borate-treated logs is that the depth of penetration can be verified by simple color-reaction tests. (Fig. 2) More details about these tests and the diffusion process are available in videotapes in ½ inch VHS format (USFS).[1/]

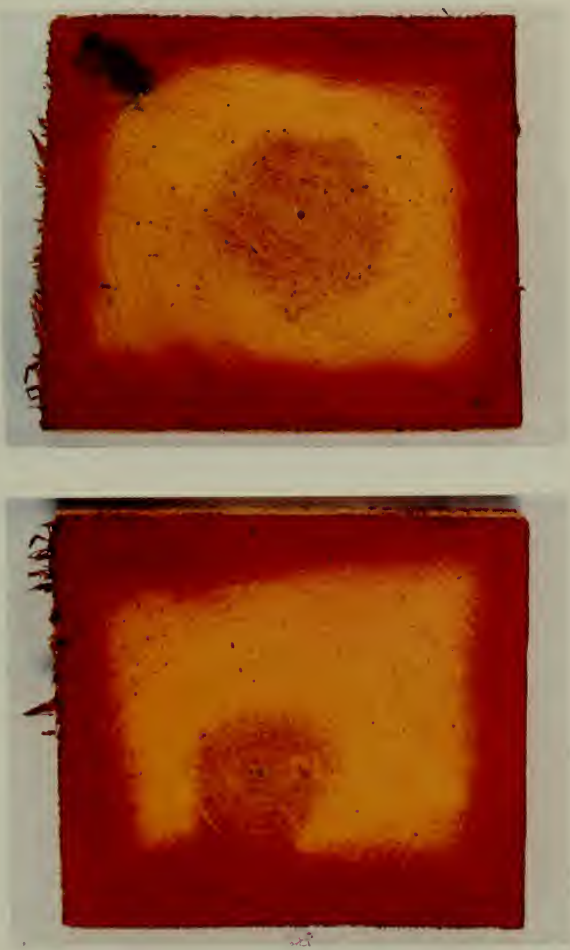

Fig. 2. *Wood samples treated with Tim-Bor®, an EPA registered wood preservative. The color graduation from the surface to the center of the wood indicates the extent of treatment. (United States Borax and Chemical Corporation Photo)*

[1/] Write to: William H. Sites, USDA Forest Service, Region 8, Forest Pest Management, P.O. Box 2680, Asheville, NC 28802, for self-addressed, postage-paid video tape request form.

PREVENTING DECAY

By Using Building Designs and Construction Techniques That Keep Logs Dry

Assuming that sound logs are delivered to the building site, decay can be prevented by use of building designs and construction techniques that protect logs from excessive wetting. Wide roof overhangs and long porches, especially on the sides of the structure most frequently exposed to wind-blown rain, are very important for keeping logs dry. It is nearly impossible to keep the walls of two-story homes dry (Fig. 3). Wherever end grain of logs is exposed, such as windows, doors and end-to-end joints of logs, it should be protected from rainwetting because wood primarily absorbs water through the end grain (Fig. 4). Many log home manufacturers do not adequately protect the end grain of logs exposed at openings in the walls. Protection should include the use of preservative chemicals as well as flashing, trim, and caulking. As in any structure, site drainage should be altered to assure that water drains away from the house on all sides.

Fig. 3. *The logs in this two-story house have been stained from continual rainwetting. Roof overhangs should be at least 24" wide to offer more protection. (GFC Photo)*

Fig. 4. *These log ends are continually exposed to rainwetting. (GFC Photo)*

PREVENTING DECAY
By Maintaining Exterior Log Surfaces

Variations of three types of logs are available in modern log-home kits: (1) whole logs from small-diameter trees consisting primarily of sapwood, (2) squared logs consisting primarily of heartwood from large-diameter trees, and (3) round logs shaped from squared logs from large diameter trees consisting primarily of heartwood. These types of logs vary in their degree of susceptibility to fungi and insects, but all require protective treatments on their exposed surfaces. Special precautions must be taken when small-diameter, mostly sapwood logs are used in construction.

All exterior surfaces of logs should be brush- or spray-treated soon after house erection with a wood preservative formulation that also contains a water repellent. Ideally, the formulation should contain both a fungicide and an insecticide because beetles that infest relatively dry wood in use are present in Southern and Atlantic coastal states (APPENDIX). Wherever wood end grain is exposed to frequent wetting, such as at house corners, it should be thoroughly treated. The exterior surfaces should be retreated after about 6 and 18 months and, thereafter, at 4-5 year intervals. This will assure that untreated wood that is exposed as wood checks and splits during seasoning will receive treatment. Large checks and splits, especially those on the upper faces of logs, should be caulked following treatment to prevent entry of moisture. These exterior maintenance procedures also should be followed on homes fabricated from logs that have been pressure treated with preservative chemicals to protect untreated heartwood exposed at checks.

Wood sealers or film-forming finishes should not be used on either the interior or exterior surfaces of logs until at least one heating season has passed. Film forming finishes and "sealers" tend to trap moisture in logs and promote decay.

IDENTIFYING, PREVENTING AND CONTROLLING INSECT INFESTATIONS IN LOG HOUSES

Log houses are susceptible to attack by many different insects with very different habits. Termites may attack nearly any wood species. Other insects will use wood of many species, or beetle exit holes in logs, only as nesting sites. Various beetles are the most common problem.

Beetles That Attack Freshly Cut Logs

Softwood species are most often used for log homes, and include pine, spruce, fir, hemlock, northern white-cedar, western redcedar, and cypress. In warm weather, freshly cut logs of all softwoods frequently are attacked within a few days after tree felling by beetles commonly called buprestid or metallic wood borers (larvae are called flat-headed borers, Fig. 5) and by long-horned beetles (adults are often called pine sawyers, larvae are called round-headed borers, Fig. 6).

Fig. 5. (A) *Larva of a metallic wood boring beetle. (SFIWC Photo)*

Fig. 5. (B) *Adult metallic wood boring beetle. (Van Waters and Rogers Photo)*

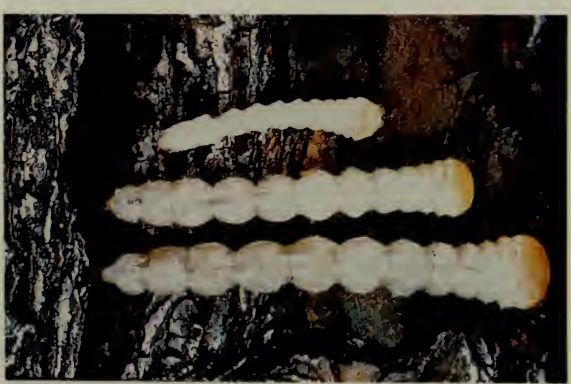

Fig. 6. *Larvae of the longhorned beetle. (SFIWC Photo)*

These borers lay eggs in bark (Fig. 7); eggs hatch within 2 to 4 weeks. Larvae feed for a few weeks just under the bark before boring into the log, going deeper as logs dry (particularly the buprestids). The life cycle usually is 1 to 2 years, but larvae may feed for at least 6 years when wood moisture is low. During each year, new holes appear as adults emerge (Fig. 8).

When many holes appear in the log walls of structures and homeowners hear chewing, rasping sounds of more feeding larvae within logs, they worry about the permanence of their house. No one can definitely say how many more adults might emerge or for how long. Emerging adults cannot infest dry logs lacking bark, so infestations will die out of their own accord after all larvae have completed their life cycles. However, alarmed homeowners want immediate control; therefore, fumigation is often done even though the money could be better spent on other measures (see old house borer, next section).

Clearly, prevention of these wood borers is the responsibility of the manufacturer. Surface applications of insecticides will not kill larvae deeply within logs and fumigants often do not penetrate "wet" logs effectively. Therefore, prevention is much easier than control. How well prevention is achieved depends on how quickly freshly cut logs are debarked and on how deeply treatment chemicals penetrate into wood. If debarking is delayed, larvae may be below the depth that nondiffusible chemicals will penetrate. Surviving larvae will continue to feed and may later emerge as adults. Treated wood is not ingested by emerging adults, so a quick-acting contact insecticide must be used to prevent emergence (APPENDIX).

Ambrosia beetle adults also attack hardwood and softwood logs, usually before and sometimes after debarking. Females bore around tunnels (⅛-inch diameter or less) deeply across grain to lay eggs and inoculate the wood with ambrosia fungus. Tunnels lack boring dust which is expelled and their walls are stained dark brown or black. It is best to debark logs quickly; the fungus does not grow as wood dries below 30% moisture content. Adults sometimes attack erected houses, particularly when logs are rewetted or are freshly finished with stains that contain alcoholic solvents which attract these beetles. Offspring rarely survive from such attacks.

Fig. 7. *Wood boring beetles lay their eggs in small pits which they chew in the bark. (SFIWC Photo)*

Fig. 8. *Exit holes made by adult wood boring beetles may be oval to flattened in shape depending on the species. (GFC Photo)*

Beetles That Attack and May Reinfest Dry, Debarked Wood

Adults of a round-headed borer, commonly called the **old house borer**, are strong fliers and are attracted to odors from recently processed softwoods. They infest only pine, spruce, or fir when wood moisture content ranges from 30% to 10%. Old house borers (Fig. 9) do not resemble adult buprestids, but the ¼ to ⅜-inch oval exit holes (Fig. 10), powder in tunnels, and chewing sounds of larvae are very similar and often confused. Adults emerge during June and July in most locations. Eggs are laid in small cracks on wood surfaces during June through possibly September. In the South a minimum of 2 to 3 years is required from egglaying until adults emerge. Infestations in houses less than 2 years old means the logs were infested before construction.

Logs infested before treatment may remain infested when non-penetrating chemical treatments allow larvae to survive in untreated log centers. These larvae emerge as adult beetles that chew holes without ingesting treated wood.

Fig. 9. *An old house borer adult next to exit hole. (USFS Photo)*

These beetles may survive to lay eggs in untreated wood exposed in exit holes or in cracks as partially seasoned logs continue to dry. Unless a deeply penetrating treatment has been used, insecticides (APPENDIX) must be applied to exterior walls either before or with the scheduled water repellent preservative treatment required for prevention of decay fungi. Insecticide surface treatments will not kill larvae deep in wood and are not recommended for interior surfaces; finishes further limit effectiveness. Injection treatments (APPENDIX) into exit holes may be effective for limited infestations inside homes.

Heavy, widespread infestations may need to be fumigated. Fumigants provide no residual protection, do not penetrate "wet" logs very well, and often fail to control beetles in log houses. But fumigation may give immediate control and is a corrective measure accepted by financial institutions when houses are being sold. Old house borer (and buprestid) larvae tend to concentrate in exterior log surfaces where moisture is high. Beetle exit holes and tunnels rarely cause structural damage, but moisture that accumulates in them promotes the growth of decay fungi. Therefore, money spent for fumigation could be more effectively spent for water repellent preservative plus insecticide treatments of exterior log surfaces and for other measures needed for long-term protection against decay, old house borers, and anobiid beetles.

Fig. 10. *Many of the wood boring beetles produce exit holes that are similar in size and shape. The holes in this photo were made by at least two separate species. (GFC Photo)*

Anobiid beetles naturally occur throughout the South and may attack untreated wood in exterior logs or exposed wood in crawl spaces. Wood must have a moisture content above 13% (but preferably below 20%). Pine and yellow-poplar are often attacked, but many other hardwoods also are susceptible. Cedar and western softwoods are not attacked by the most common anobiid species in the South (Fig. 11). Anobiid infestations in recently processed logs are limited to occasional minor ones by species that only infest bark (these need no control).

Fig. 11. *This Anobiid beetle is widely distributed throughout the Eastern states and is the most common in the Southeastern states. (SFIWC Photo)*

Lyctid powderpost beetles only attack hardwoods with large pores and 3% or more starch content. These beetles usually reinfest wood and may severely damage sapwood portions of oak or walnut logs sometimes used for log homes. Recently processed hardwood molding, picture framing, flooring, and furniture are often infested (Fig. 12).

Anobiid- or lyctid-infested wood from old buildings is sometimes reused for bookcases, paneling, flooring, or picture framing. If round ⅛-inch diameter holes and powder-filled tunnels are in such wood, it should be discarded or possibly fumigated or kiln-dried before use. Piles of fresh-looking powder on or beneath wood suggests live larvae are present.

Powder of anobiids feels gritty, lyctids like talcum powder. Anobiid adults may emerge from infested wood placed in centrally heated or air-conditioned spaces, but wood moisture will be too low for survival of small larvae. This is not true for lyctids. To kill lyctids before using wood, move wood from 60 to 80°F temperatures and store at 0°F or below for at least 48 hours for 1-inch-thick wood.

Fig. 12. (A) *A picture frame infested with lyctid powder post beetles. Note the talcum powder-like boring dust.*

Fig. 12. (B) *Adult lyctid beetle. (USFS Photos)*

Insects That Use Wood As A Nesting Site

Carpenter ants, carpenter bees, and many solitary wasp and bee species are common in log houses. These insects are primarily a nuisance, and are not likely to cause serious damage quickly.

Carpenter ants often nest in stumps or other buried wood outside the home and enter homes to find sugar or organic matter as food. Ant workers, ¼ to ½ inch long and reddish brown to black, (Fig. 13), do not eat wood, but excavate shallow nests with smooth (as if sanded) walls, preferably in moist, decaying wood. Preferred nesting sites are readily available in exterior log surfaces, around windows and doors, and in heartwood log centers in many houses. The nests cause only minor damage unless large colonies are present for several years.

If the main nest of the ants is outside, it must be located and treated for satisfactory control. Reducing moisture traps for decay prevention also reduces favorable nest sites for ants.

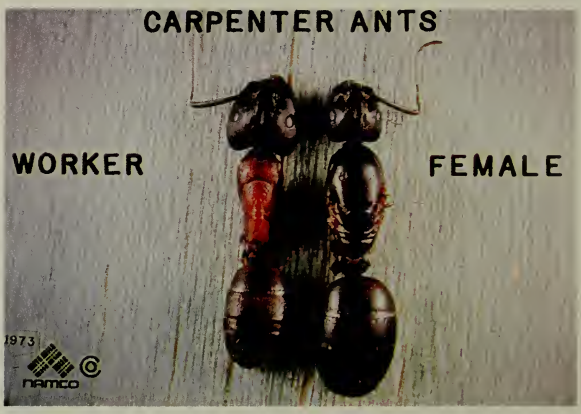

Fig. 13. *Carpenter ants; adult female shown with wings removed. Male and female reproductives have two pairs of membranous wings of unequal size. (Van Waters and Rogers Photo).*

Adult **carpenter bees** resemble bumble bees. Both have yellow hair over most of their black bodies, but the carpenter bee differs by having a hairless abdomen (Fig. 14). The adult female bee bores a ⅜- to ½-inch round hole into wood, makes a right angle turn, and tunnels along the grain of the wood. Wood is not ingested, but discarded out the entrance hole (Fig. 15). The tunnel is partitioned into cells, each containing a ball of pollen and nectar and egg. The offspring feed on this food until mature, then all emerge through the hole made by the parent female. Young adults overwinter until April or May, feed on nectar, mate, and often reuse the tunnel where they were reared to lay eggs. Reused tunnels may be several feet long. Repeated tunneling may weaken an individual timber.

Fig. 14. *A carpenter bee. Note the hairless abdomen. (GFC Photo)*

Fig. 15. *Carpenter bee holes can be distinguished from other insect holes by their size and rounded shape. (GFC Photo)*

Solitary wasps and **bees** place food and eggs in beetle exit holes in log walls and seal the hole with a "wall" of dirt (Fig. 16). The offspring bores a small hole in the wall of dirt to come out, often causing powdered dirt to accumulate beneath the hole. This is sometimes mistaken for a beetle infestation. These insects do not harm wood; caulking beetle holes to prevent decay eliminates them.

Carpenter bees can be controlled by injecting recommended insecticides (APPENDIX) into nests and tunnels. Dust formulations often work best. Seal treated bee holes with a dowel rod or silicone sealer. Preventing nesting by bees in logs is very difficult, even pressure-treated wood is sometimes attacked. Painting frequently-attacked timber will sometimes discourage bees.

Fig. 16. *This beetle exit hole is being used by a solitary nesting wasp. Note the red dirt packed over the entrance. (GFC Photo)*

Termites

Log houses should not be any more susceptible to **subterranean termites** than conventional houses if soil beneath and around foundations is treated before construction with a recommended insecticide (APPENDIX). (This treatment is best done by a licensed pest control operator with proper equipment). The soil treatment creates a toxic barrier between termite colonies in the soil and wood in the home. For a better barrier, avoid earth/wood contacts and wood

near soil (Fig. 17). Log houses in southern coastal regions will remain very susceptible to **drywood termites** unless exterior logs are well-treated with a deeply penetrating chemical or treated regularly with an insecticide. Drywood termites fly to wood and need no contact with soil to live.

Fig. 17. *Wood to ground contact should be avoided at all times. (USFS Photo)*

SUMMARY

Buying a log-kit home is like buying a new car, frequently decisions are based on appearance rather than long-term performance. Cars as well as homes are not all designed and built in the same way; some will require more maintenance than others. If the home is chosen because of its appearance (design, floor plan and log shape) without considering wood protection, then buyers may later face high maintenance costs.

Before choosing a log-kit, prospective buyers should inquire about the log handling, storage and treating practices of several manufacturers.[1] To ask appropriate questions, buyers should first learn something about fungi, insects, and treatments to prevent them.

For example, chemical treatments and other practices used to prevent fungi and insects in **unseasoned** wood often are designed to protect logs during processing and construction and may not provide continued protection of wood once it is seasoned and in a house. This is why design features, log shapes, and types of treatments must be considered when choosing a log-home kit. Homeowner-applied maintenance treatments usually will be needed for long-term protection even though logs have been treated by the manufacturer. These maintenance treatments should include both an insecticide and a preservative formulation that contains a water repellent; the appropriate combination depends upon the type of treatments applied during manufacture.

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[1] *The winter quarterly issues of two log home journals provide directories of many manufacturers. These are: Log Home Guide for Builders and Buyers (ISSN 0707-5006) and Log Homes Annual Buyer's Guide (ISSN 0743-7293).*

APPENDIX

TREATMENTS FOR SPECIFIC PESTS OR USE SITES[1]/

For a list of labelled products by trade names, contact the county agent or other authorized source in your area. Use of some products may not be permitted in your area.

CARPENTER ANTS AND CARPENTER BEES

For injection into crevices, holes, and tunnels in wood: formulations containing one or more of the following active ingredients: bendiocarb, boric acid, carbaryl, chlorpyrifos, diazinon, fenvalerate, propetamphos, or propoxur. Many formulations with these ingredients can also be applied as wood surface sprays.

ANOBIID BEETLES, LYCTID POWDERPOST BEETLES, OLD HOUSE BORERS

For injection into holes and tunnels in wood within structures: formulations containing one or more of the following active ingredients: chlorpyrifos as PT® 270 Dursban; pyrethrins plus piperonyl butoxide plus silica gel plus petroleum distillate as PT® 230 Tri-Die, lindane as Xylamon® Wood Worm Killer or Xylamon LX-Hardening®.

For wood surface sprays within structures: chlorpyrifos as Dursban® L.O.

For surface sprays of exterior log walls: formulations containing one or more of the following active ingredients: 1.0% chlorpyrifos as Dursban® L.O. or Dursban® TC, 0.5% lindane (numerous formulations).

DRYWOOD TERMITES

For treatment of wood or galleries within structures: formulations containing one or more of the following active ingredients: silica gel plus ammonium fluosilicate, pyrethrins plus piperonyl butoxide plus silica gel plus petroleum distillate, chlorpyrifos as PT® 270 can be injected into galleries.

SUBTERRANEAN TERMITES

For soil treatment by certified applicators: formulations containing one or more of the following active ingredients: chlordane, chlorpyrifos, cypermethrin, permethrin, heptachlor, and isofenphos. Formulations containing bendiocarb, boric acid, chlorpyrifos, or propoxur can be injected into galleries if specified on label.

FOR ALL THE ABOVE PESTS EXCEPT CARPENTER BEES AND SUBTERRANEAN TERMITES OTHER THAN THE FORMOSAN SUBTERRANEAN TERMITE, FUMIGATION WITH PRODUCTS CONTAINING EITHER METHYL BROMIDE OR SULFURAL FLUORIDE CAN BE DONE IF CIRCUMSTANCES WARRANT SUCH TREATMENT.

MOISTURE AND DECAY PREVENTION (exterior walls)

For brush or spray applications by homeowners - Formulations containing both a water repellent and a biocide such as copper - 8 - quinolinolate (e. g., Woodgard II®), tributyltin oxide plus Folpet® (e. g., Olympic Clear Wood Preserver®), 2-(thiocyano-methylthio) benzothiazole plus methylene bis (thiocyanate) (e. g., Seal-Treat II wood preservative®), diiodomethyl-para-tolylsulfone plus zinc napthenate (e. g., Wolman Clear Wood Preservative®). Many other formulations containing copper napthenate impart water repellency but also impart a greenish discoloration to wood.

TREATING UNSEASONED LOGS (use by individuals)

Dip-diffusion treatments with a borate (disodium octaborate tetrahydrate such as TIM-BOR®) plus a fungicidal additive (diiodomethyl-para-tolylsulfone as Amical® Flowable or 2-(thiocyanomethylthio) benzothiazole plus methylene-bis (thiocyanate) as Busan 1009®, specify formulation that is compatible with borates) are recommended because deeply penetrating protection against insects and decay fungi may be achieved (Fig. 2).

[1]/ Some states have restrictions on the use of certain pesticides. Check your state and local regulations. Also, because registrations of pesticides are under constant review by the U. S. Environmental Protection Agency, consult your state forestry agency, county agricultural agent or state extension specialist to be sure the intended use is still registered. Trade names used in this publication are solely for the purpose of providing information. Mention of a trade name does not constitute a guarantee or warranty of the product by the Georgia Forestry Commission, USDA Forest Service or the Mississippi Cooperative Extension Service over other products not mentioned.

PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in their original containers under lock and key out of reach of children and animals, and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear appropriate protective clothing.

If your hands become contaminated with a pesticide, wash them immediately with soap and water. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove the clothing immediately and wash skin thoroughly. After handling or spraying pesticides, do not eat or drink until you have washed with soap and water.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicide from equipment, do not use the same equipment for insecticides or fungicides that you used for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary landfill dump, or crush and bury them in a level, isolated place.

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